SEPTEMBER 1995

CALTRAIN SAN FRANCISCO
DOWNTOWN EXTENSION PROJECT
CONCEPTUAL DESIGN AND DRAFT EIS/EIR

MTC CalTrain Ridership Forecasts Travel Model Assumptions Report

PENINSULA CORRIDOR JOINT POWERS BOARD

ICF KAISER ENGINEERS/DELEUW CATHER TEAM
in association with
JAMES & MOORE, AGS, AND MIG

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CALTRAIN S.F. DOWNTOWN STATION RELOCATION EIS/EIR

MTC CALTRAIN RIDERSHIP FORECASTS
TRAVEL MODEL ASSUMPTIONS REPORT

PREPARED FOR

[illegible] CORRIDOR JOINT POWERS BOARD

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UNDER SUBCONTRACT TO
ICF KAISER ENGINEERS, INC.

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1.0 Introduction

This report describes the methodologies that will be used applying the Metropolitan Transportation Commission (MTC) travel demand forecasting model results in the preparation of transit patronage forecasts for the CalTrain San Francisco Downtown Extension Project Environmental Impact Statement/Environmental Impact Report (EIS/EIR). Documentation is provides details of current data available, model structure, techniques to estimate station mode of access, updates for special generators in the corridor and model calibration procedures. The methods and approaches outlined in this report reflect those used in other recent AA/DEIS/DEIR studies prepared for the Federal Transit Administration (FTA). This report presents a summary of the key patronage forecasting methodologies and input assumptions identified by the project team for the CalTrain Downtown Extension EIS/EIR to adequately address state and federal environmental review requirements.

1.1 Purpose of Forecasts

Transit patronage forecasts are a fundamental input into the analysis of fixed guideway transit projects. This environmental review phase seeks to evaluate the environmental impacts of the proposed transit improvements. Policy makers and the general public will also want to know how the transit alternatives will attract new transit riders and improve service to existing riders. Furthermore, the analysis will include a computation of operating and maintenance costs for each of the alternatives. For each of these measures, a comparison will be made between the level of daily and annual patronage for the proposed fixed guideway alternatives versus a no build alternative.

The technical planning process sponsored by FTA for federal funding of fixed guideway transit projects is highly dependent of transit patronage forecasts that are sensitive to differences across the range of transit alternatives studied. The patronage forecasts are critical input to the assessment of benefits derived from the build alternatives as compared with the No Build alternatives.[1]

Traditionally, in the assessment of cost-effectiveness, the FTA considered benefits to be:

- Attraction of new transit riders;
- Improvement in service (travel times) for existing riders; and
- Reduction in operating and maintenance costs.

These analysis requirements require use of an acceptable regional travel demand model that encompasses the appropriate level of detail and produces reliable performance measures. These include transit service levels, line-by-line patronage, station boardings, transfers and zone-to-zone travel times. The model should also represent the entire transportation system--roadway, transit and

[1]The No Build Alternative will encompass transportation improvements customarily included in the TSM Alternative of a FTA transit study. See Section 4.2.1.

walk networks–as accurately as possible. Station mode of access and station choice decisions are another important aspect of the patronage forecasts that should be addressed in the study.

While these measures remain relevant to the evaluation process, a September 1994 FTA policy paper (*Revised Measures for Assessing Major Investments: A Discussion Draft*) presents the measures that FTA now plans to use in assessing new projects. The Ridership Forecast Results Report will address these measures to the degree that they can be added to the measures already under consideration:

- Cost-Effectiveness

    1. Total incremental cost per incremental transit passenger trip;

- Mobility Improvement

    1. Aggregate value of travel time savings per year,

    2. Number of zero-car households (or the number of residents) located within one-half mile of boarding points fro the proposed system increment;

- Operating Efficiency (per vehicle service-hour or service-mile)

    1. Projected change in operating cost,

    2. Projected change in passengers,

    3. Projected change in passenger miles;

- Environmental Benefits

    1. Forecast change in criteria pollutant emissions and in greenhouse gas emissions,

    2. Forecast change in the consumption of fuels of different types;

- Transit Supportive Existing Land Use Policies and Future Patterns

    1. The degree to which local land use policies are likely to foster transit supportive land use, measured in terms of the kinds of policies in place and the commitment to these policies.

1.2 Use of MTC 1994 RTP Runs

The ridership forecasts for the Downtown Extension Project will be based on MTC travel demand model runs prepared for the 1994 Regional Transportation Plan (RTP). The customary approach for preparing forecasts for a major transit study is to conduct new travel model runs specifically for

the study. This approach was explored in a series of meetings between the JPB, MTC modeling staff, and the consultant team at the initiation of the EIS/EIR work effort. These meetings resulted in the decision to use the existing output from the RTP model runs that were prepared in 1994. In large part, this was MTC's decision, since they maintain and operate the regional travel model. MTC felt that using the RTP runs was the best course of action for the study.

Utilization of the RTP runs will require that a number of manual adjustments be made to the existing output to make it suitable for preparing ridership forecasts for the Downtown Extension Project. In part, this is because the scenarios included in the RTP were design to test different policy approaches to investing in the Bay Area's entire transportation system over the next 20 years. As a result, each RTP alternative made very different assumptions about the region's transportation network. Ideally, for a study of a single transit improvement, model runs would be prepared that only varied the system being improved, and holds the rest of the network constant. Manual adjustments will be needed to make the RTP model output most like that produced by a traditional analysis approach.

Other adjustments will be necessary because of the MTC model's structure, application, and relative insensitivity to local conditions. For example, adjustments will be needed to account for differences in travel time due to station spacing and diesel versus electric operation, connections between BART, CalTrain and the Airport Light Rail System, and the method used to model parking capacity constraints at CalTrain stations. These adjustments are described in detail in Chapter 6.0.

1.3 Contents of This Report

Chapter 1 describes the purpose of the ridership forecasts, the reasons for using the 1994 MTC RTP model runs, and the contents of the remainder of the report.

Chapter 2 describes the background of travel forecasts that have previously been prepared for the corridor. It describes previous CalTrain extension studies, the history, alignments and CalTrain connections of the BART extension to San Francisco Airport, and a summary of the RTP forecast results applying to the Peninsula Corridor.

In Chapter 3, a description of the MTC model is presented in an overview format. Information is provided for the model elements of land use/socio-economic inputs, network assumptions, travel behavior, performance outputs, and categories for reporting model results.

Chapter 4 describes the methodology to be used in preparing the ridership forecasts for the Downtown Extension Project. It includes a description of the alternatives included in the RTP that are relevant to the forecasting effort, a description of the Downtown Extension alternatives to be analyzed, a correspondence table between the RTP and CalTrain alternatives, and a step-by-step listing of tasks to be performed in the forecasting effort.

Chapter 5 includes a discussion of the key analysis evaluation measures to be presented in the analysis. These include output measures of transit service levels, transit patronage by line, travel times and transfers.

Chapter 6 describes the manual adjustments that will be necessary to utilize the RTP model runs for the CalTrain extension forecasts. These include adjustments resulting for the particular definition of the RTP alternatives, the structure of the model itself, assumptions in the inputs used for the RTP runs, and methods of applying the model to the RTP alternatives under review.

2.0 Background of Travel Forecasting in Corridor

Since the early 1970s, future transportation needs between the Peninsula and downtown San Francisco have been estimated in a number of studies including:

1. San Francisco Airport Access Project (SFAAP) Study, which evaluated three corridors and 20 BART alignments from Daly City to the San Francisco Airport (1972).

2. Senate Concurrent Resolution No. 74 (SCR 74) - Peninsula Mass Transit Study, which evaluated various systems level transit alternatives from San Francisco to San Jose, including high occupancy vehicle lanes, light rail transit, CalTrain upgrades and electrification, and BART (1985).

3. Peninsula Commute Service Interim Upgrade Study, which investigated an extension of CalTrain service to the Transbay Terminal (1987).

4. Phase 1 BART-San Francisco Airport Extension/CalTrain Upgrade Pre-Alternatives Analysis/DEIS, which evaluated six alternatives: 1) No Build; 2) Transportation Systems Management (TSM); 3) a BART extension to an external Airport station; 4) an upgrade of CalTrain; 5) light rail transit from San Francisco to San Jose; and 6) an extension of BART to the center of the Airport garage (1990).

5. BART-San Francisco Airport Extension Alternatives Analysis/Draft Environmental Impact Statement/Draft Environmental Impact Report (AA/DEIS/DEIR) (1992).

6. The Metropolitan Transportation Commission (MTC) 1994 Regional Transportation Plan (RTP) (1994).

In addition, a number of studies have been performed of transportation conditions in Downtown San Francisco, including the Terminal Separator Structure/Mid-Embarcadero Roadway Study (1994).

The SFAAP and SCR 74 studies are older and their forecasts have been reviewed and revised in subsequent studies. They do not provide meaningful information to the current forecasting effort, except as historical background. Throughout all of the previous studies, the most influential factor on corridor ridership has been the assumptions about the BART extension to San Francisco Airport.

2.1 Peninsula Commute Service Interim Upgrade Study (1987)

The Peninsula Corridor Study Joint Powers Board commissioned an Interim Upgrade Study (IUS) of the proposed extension of the Peninsula Commute Service (PCS) to the Transbay Terminal in San Francisco, which was completed in 1987. One of the objectives of this study was to refine previous ridership projections to determine an accurate prediction of the increase in ridership due to the extension.

The SCR-74 study had projected increased ridership to about 44,400 total daily trips with a 68-train service and the proposed downtown extension. The IUS determined that the future ridership potential of an expanded Peninsula Commute Service would actually be much greater. It determined that ridership would probably reach 70,000 trips per day by year 2000 with a much faster and more convenient 136-train schedule, and could possible be as high as 94,000 under certain circumstances (high costs of auto operation and downtown parking). However, there are various important factors which were determined to affect future ridership, some of which are matters of public policy and others are internal factors which are impossible to predict with precision.

2.2 BART-SFO Airport Extension (1992 and 1995)

In response to the SCR-74 study of the mid-1980's, the Federal Transit Administration (FTA), which was then called the Urban Mass Transportation Administration (UMTA), authorized the initiation of the federal AA/DEIS process for a project corridor in northern San Mateo County. MTC, San Mateo County Transit District (SamTrans), the San Francisco Bay Area Rapid Transit District (BART), serving as the co-lead agencies for the EIR, and the FTA, serving as the lead agency for the EIS proceeded with a combined study consistent with both the state and federal environmental processes.

The result for this joint process was an Alternatives Analysis/Draft Environmental Impact Statement/Draft Environmental Impact Report (AA/DEIS/DEIR) for the BART-San Francisco Airport Extension completed in March 1992. The document identified six alternatives for connecting the Colma BART Station, which is currently under construction, with the San Francisco International Airport (SFIA). These alternatives ranged from not building the project, to linking northern San Mateo County with San Francisco through enhanced bus and CalTrain service, to extending BART rail service from Colma to the vicinity of the SFIA. In Spring 1992, BART, SamTrans, and the MTC, made their initial selection of a "Locally Preferred Alternative" (LPA). This initial Locally Preferred Alternative became the focus of more detailed preliminary engineering and environmental documentation.

The initially selected route generally followed the San Bruno branch of the Southern Pacific Transportation Company (SPTCo) railroad between Colma and San Bruno, and then merged with the SPTCo mainline between San Bruno and Burlingame (the CalTrain route). Stops in the project corridor include South San Francisco, San Bruno, and Millbrae. The alignment called for an at-grade Airport Intermodal Station west of Highway 101 opposite the SFIA terminals. A transit connection between BART, CalTrain, and the Airport Light Rail System (ALRS) would be available at the Airport Intermodal Station.

Following the initial selection of a Locally Preferred Alternative, the typical next step in terms of the environmental process is to prepare the Final EIS/Final EIR (FEIS/FEIR). However, BART and SamTrans decided to instead prepare a new DEIR for recirculation and a Supplemental Draft EIS (SDEIS) to augment the original AA/DEIS/DEIR and encompass the same analysis included in the new DEIR. In general, it is the purpose of this document to provide information needed by BART and SamTrans to either select a new alternative or confirm the initial Locally Preferred Alternative. Once the document was completed, BART and SamTrans selected a new Locally Preferred Alternative, called Alternative VI.

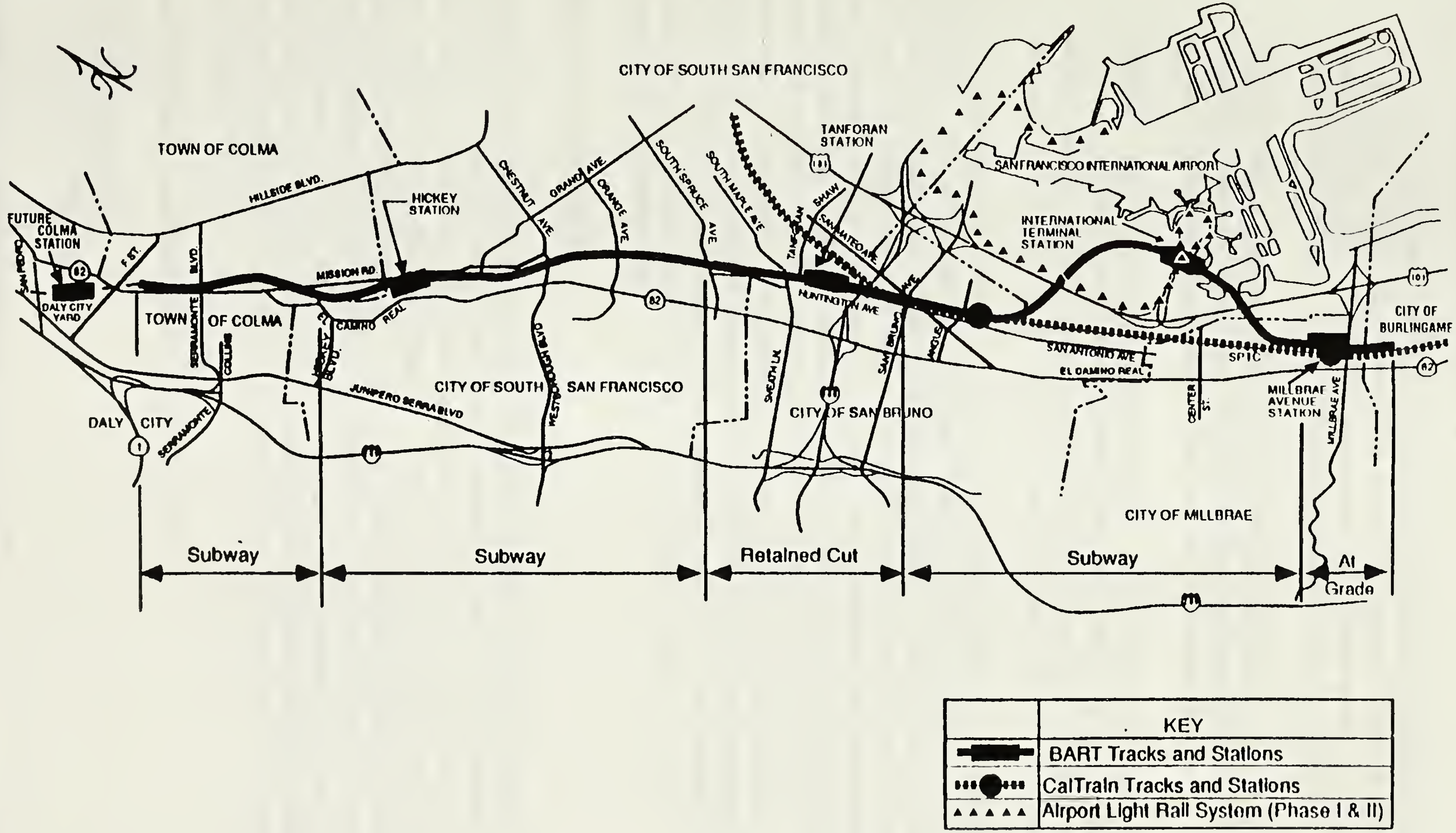
This new alignment alternative, shown in Figure 1, was developed after the ridership forecasts were prepared for the DEIR, and after the ALRS system was defined. Alternative VI follows the SPTCo railroad (San Bruno branch) right-of-way between the future Colma BART Station tailtrack and the San Bruno branch junction with the SPTCo/CalTrain mainline in San Bruno. The alignment then proceeds in a subway through downtown San Bruno, turns east in a subway under Highway 101, and proceeds to a subway station at the proposed Airport International Terminal. South of the Airport International Terminal, the alignment curves southwest under Highway 101 and rises to a Millbrae BART/CalTrain Station at Millbrae Avenue. An at-grade BART turnback and tailtrack extend south of the Millbrae Station approximately 1,500 feet into the City of Burlingame.

The Airport International Terminal Station would be adjacent to and beneath the proposed International Terminal. BART passengers could access the Airport International Terminal ticketing area by elevators, escalators, or by walking. The other terminals could be accessed by escalators/walking from the International Terminal or via escalators/walking and transferring to the proposed Airport Light Rail System (ALRS). Access to employee areas north of the SFIA terminals would be provided by escalator/walking of approximately 500 feet to the new Airport Ground Transportation Center (GTC) and transferring to the ALRS. Parking for BART patrons would not be available at this station.

To accommodate the at-grade Millbrae Avenue Station, the existing CalTrain station building would be moved approximately 15 feet to the west. The existing CalTrain southbound track would also be moved approximately 12 feet west, and the northbound track moved approximately 12 feet east in the station area. The CalTrain platform would be relocated approximately 1,000 feet north. The BART and new CalTrain station platforms would be located side-by-side, with transfers by way of an aerial bridge. Approximately 3,000 parking spaces would be provided (2,150 in a four-level parking structure and 850 in a surface lot). A pedestrian bridge would connect the parking structure with the BART and CalTrain mezzanines. The main vehicular access for commuters from the south would be via Highway 101 and Millbrae Avenue. Local access to the station would primarily be via Millbrae Avenue, El Camino Real, Rollins Road, or California Drive. California Drive would be extended to Linden Avenue to provide access to the west side of the station.

Transfer opportunities would be created between BART and CalTrain at the Millbrae Avenue Station, and between BART and the ALRS at the Airport International Terminal Station. Transfers between CalTrain and the ALRS would require the intermediate use of BART. CalTrain passengers wishing to reach the Airport would transfer to BART at the Millbrae Station.

The Airport Light Rail System (ALRS) would be constructed by the SFIA. The ALRS is proposed as an electric-powered monorail system running on a fixed guideway. The ALRS would provide free service, connecting all passenger terminals, the proposed Airport Ground Transportation Center (GTC), hotels, long-term parking lots, aircraft maintenance facilities, and the SFIA's proposed ferry service terminal.



Source: BART - SFO SDEIR / SDEIS, January 1995

Korve Engineering

CALTRAIN DOWNTOWN EXTENSION

Figure 1

ALTERNATIVE VI

Millbrae Avenue via the Airport International Terminal

The ALRS would be built in the following phases:

- **Phase Ia - Terminal Complex.** This portion of Phase I is a dual-loop system that connects the existing terminals to the future International Terminal and the GTC proposed by the SFIA. The ALRS trains operate on different levels as clockwise and counterclockwise loops, with three-minute headways in each direction.

- **Phase Ib - Airport Intermodal Station and Remote Parking.** In the second portion of Phase I, the dual guideway branches off from the terminal complex dual-loop system, travels west then north to serve the remote parking facilities.

- **Phase II - Ferry Service and General Aviation.** This phase extends the ALRS east to serve a proposed United Airlines parking structure, a terminal for a proposed ferry service network, and the possible relocation site for the commuter/general aviation terminal. One ALRS station would be provided at each of these three locations.

For the DEIR, travel demand was forecast for 1990 and 2010 based on the same 1994 RTP MTC model runs that will be used for the CalTrain Downtown Extension Project ridership forecasts. The RTP forecasts are described in more detail in the following section. The MTC model is a regional travel demand model which allocates "total trips" in the region to various transportation modes. The travel modeling process used for the analysis, like other such methodologies conventionally used to perform regional planning for federal review, principally reflects relative travel time differences computed for the different alternatives. Because the model is regional in nature, it is not sensitive to small differences in alternatives, the reliability of service, transit vehicle capacities, nor other subjective factors such as the location of transfer points, which may affect actual patronage in a "real world" case. Nevertheless, these differences are not considered significant, and models of this type are used nationally for Alternatives Analysis studies. This model is required to be used because it is the MPO's regional forecasting tool.

2.3 1994 RTP Forecasts

As part of preparing the 1994 Regional Transportation Plan (RTP), travel forecasts were prepared using the MTC model. General model results were reported in the RTP Environmental Impact Report. More detailed summaries than those contained in the EIR were reported in a Technical Memorandum *Detailed Travel Forecast Results - A.M. Peak Hour Person Travel at County Screenlines and Rail Transit Forecasts,* June 1994. This memo describes overall congestion levels on the Bay Area's freeways, as well as overall transit patronage at key county lines. It also includes summaries of rail station ridership, as well as travel patterns. MTC intends that the highway and transit networks developed for the RTP will become the bases for future corridor-level studies. The Fremont-South Bay Corridor Study has already prepared a series of travel forecasts with the 1994 RTP used as the base forecast.

A total of seven alternatives were contained in the 1994 RTP:

1. Year 1990 base year;
2. Year 2010 No-Project Alternative;

3. Year 2010 Draft Project Alternative;
4. Year 2010 Final Project Alternative;
5. Year 2010 Alternative 1A;
6. Year 2010 Alternative 1B; and
7. Year 2010 Alternative 1C.

Based on a meeting held at MTC on April 24, 1995 it was decided that three of these seven alternatives will be used for the ridership forecasts for the CalTrain Downtown Extension:

- Draft Project Alternative;
- Alternative 1A; and
- Final Project Alternative

The Draft Project Alternative assumed that the San Francisco CalTrain terminal would be at 4th and Townsend. Alternative 1A assumed that the CalTrain terminal would be at the Transbay Terminal. The Final Project Alternative assumed that the CalTrain terminal would be at Market & Beale. These three alternatives are described in more detail in Section 4.2.

2.4 Terminal Separator Structure/Mid-Embarcadero Roadway Study

Before October 1989, the Embarcadero Freeway (State Route 480) and its associated ramps served as a link from northeastern San Francisco to I-80 eastbound and to U.S. 101 southbound. On October 17, 1989, the Loma Prieta earthquake rendered the Embarcadero Freeway and the Terminal Separator Structure (TSS) inoperable. Closure of these facilities provided the City with an opportunity to evaluate their role in serving traffic to and through the downtown area and vicinity. This was done in the Terminal Separator Structure/Mid-Embarcadero Roadway Study.

The Terminal Separator Structure (TSS) and Mid-Embarcadero Roadway Replacement Report contains a description of existing (1992/1993) and pre-earthquake (1989) traffic conditions in the downtown San Francisco study area, as well as an analysis of six potential replacement alternatives in the future analysis year 2015.

The following methodology was used to analyze the impacts of the TSS/Mid-Embarcadero Roadway Replacement Project and to develop a comparative evaluation among all alternatives. The regional MTC travel model was utilized to develop future travel forecasts for the different roadway alternatives. The model was used to quantify shifts in travel patterns due to changes in the roadway configuration (i.e., the removal of the Embarcadero Freeway, opening or closure of the Main Street/Beale Street ramps, etc.), changes in land uses within the study area and/or the surrounding vicinity, as well as changes in modal split (auto vs. transit) due to anticipated improvements to transit access to the area, as well as other factors such as traffic congestion and parking costs.

The MTC model provides reliable regional travel forecasts for the 9-county San Francisco Bay Area. However, when focusing on a specific relatively small area, such as downtown San Francisco, the model does not represent all streets and traffic volumes. To compensate for this shortcoming, a

detailed manual assignment of AM and PM peak hour vehicle trips to the street and highway network within the study area was performed. The results obtained provided the basis for traffic impact analysis (levels of service, delays and queues) and operational assessment of the six alternatives.

Two Federal Highway Administration (FHWA) endorsed analysis techniques were utilized in evaluating the operational characteristics of the study intersections: the TRAF-NETSIM software for intersections within the primary study area (bounded by Broadway to the north, Brannan Street to the south, Sansome Street/Market Street/Sixth Street to the west and the San Francisco Bay to the east), and the 1985 HCM methodology for intersections within the secondary study area (bounded by Broadway to the north, King Street to the south, Taylor Street/Sixth Street to the west and the San Francisco Bay to the east).

TRAF-NETSIM is a microscopic model which simulates individual vehicular behavior in response to traffic parameters such as traffic volumes, signal operations, pedestrians, intersection configurations, bus operations, parking maneuvers and land closures. This FHWA model outputs detailed measures of effectiveness for the street network including queue lengths, delay, travel times and speeds. The measures of effectiveness that result from the TRAF-NETSIM model for the primary study area include LOS, queue lengths, delay, travel times and speeds.

The secondary study area intersections are isolated intersections, which cannot be linked into the TRAF-NETSIM model. Therefore, the secondary study area intersections were analyzed using the HCM methodology. The results of the analysis include delay to vehicles and level of service measures for the 16 analysis intersections during the AM and PM peak hour. Fifteen intersections within the primary study area were selected for weekend (Saturday) midday analysis. They were analyzed using the 1985 HCM methodology, providing delay to vehicles and level of service measures.

The TSS/Embarcadero analysis will provide important information to analyze local transportation impacts of the CalTrain Downtown Extension Project, as described in Section 4.1.5. However, since this TSS/Embarcadero analysis focuses on Downtown San Francisco rather than regional travel, it will not be used to produce the overall ridership forecasts.

3.0 Description of MTC Model

The assessment of the mobility and access impacts for personal travel relies on MTC's travel forecasting system, MTCFCAST. MTCFCAST is a set of computerized forecasting programs that simulates travel for an average weekday of a given year. The MTCFCAST system uses econometric relationships estimated from observed travel behavior; it predicts trips produced, the distribution of trips from point of production to point of attraction, the mode of travel for each trip, and specific route of travel between origins and destinations. The components of the model system are described in the document *Regional Travel Forecasting Model System MTCFCAST-80/81: Technical Summary* (1988).

MTCFCAST forecasts personal trips, as opposed to those trips made for commercial purposes. Personal travel includes home-based work, home-based social/recreation, home-based shopping and non-home-based purposes. Commercial trips are discussed further below.

MTCFCAST uses four sets of input assumptions. These are:

1. Land use/economic/demographic forecasts;
2. Pricing assumptions;
3. Network assumptions; and
4. Travel behavior assumptions.

3.1 Land Use, Economic, and Demographic Forecasts

Land use/economic/demographic forecasts measure the growth and changes in households, working households, household population, total population, employed residents, total employment by six classifications, mean household income, and single and multi-family dwelling units. Although ABAG has produced a new series of population projections, Projections '94, the data was not available in time for use in the RTP forecasts. As a result, ABAG's Projections '92 for the years 1990 and 2010 has been used for this study.

In 1990, the nine-county Bay Area contained 6.02 million people and 3.11 million jobs. By the year 2010, the Bay Area is projected to add nearly 1.5 million new residents and more than 1.0 million new jobs. This growth represents a 25 percent increase in population, and a 33 percent increase in jobs over the twenty-year time frame.

By comparison, total person trips in the Bay Area are forecast to increase by 31 percent–from nearly 18 million to well more than 23 million. Of these trips, about 24 percent are "home-based work (HBW) trips," that is, trips either from home to work or from work to home. Each Bay Area resident is forecast to make more trips each day--3.12 trips per day in 2010, up from 2.97 in 1990. The number of automobiles owned in the Bay Area is forecast to increase by nearly 1.5 million, an increase of 37 percent. The growth in auto ownership reflects increasing household incomes.

Average household income is forecast to rise from $56,000 in 1990 to $71,300 by 2010 (in constant 1990).

These are only a few demographic trends that will affect travel patterns around the Bay Area during the next twenty years. Chapter 2 of the *1994 Regional Transportation Plan* provides a more comprehensive overview of demographic trends and travel patterns. An even more complete analysis of demographic trends can be found in ABAG's Projections series. The 1994 RTP uses ABAG'S Projections '92 data. (For a more detailed analysis of current and future travel patterns consult the MTC document: *Bay Area Travel Forecasts for Years 1990, 1996 & 2010: Auto Ownership, Trip Generation, Trip Distribution and Mode Choice--Technical Summary*, September 1993.)

3.2 Pricing Assumptions

The MTC Model's pricing assumptions include four basic costs items associated with travel: auto operating costs, parking charges, auto tolls and transit fares.

3.3 Network Assumptions

The Model's network assumptions involve highway and transit network definitions for each alternative being studied. The purpose of the highway and transit networks is twofold: first, the preparation of zone-to-zone travel times and costs as direct input into MTCFCAST; and second, for use in assigning forecast trips onto specific routes and facilities. The networks assumed in each of the RTP model runs to be used in the present forecasting effort are described in Section 4.2.

3.4 Travel Behavior Assumptions

The Model's travel behavior assumptions define level of usage, vehicle occupancy and HOV utilization assumptions, peaking factors, and off-model trip rates.

Commercial trips are forecast with a different methodology. For this trip purpose an "off-model" trip rate factor, derived from total daily non-home-based trips, is used. Although commercial travel forecasting is not as developed as forecasting personal travel, the RTP examines peak hour roadway conditions and travel times to the region's airports, seaports and city centers.

3.5 Travel Forecast Outputs

The output from the travel forecast results includes detailed highway and transit data both for A.M peak hour and daily conditions, including:

1. Person trips by mode of travel;
2. Linked transit trips;
3. Vehicle trips;
4. Mode share;
5. Vehicle hours of travel (VHT);

6. Vehicle miles of travel (VMT);
7. Average auto occupancy rates (AOCC); and
8. Average vehicle ridership rates (AVR).

3.6 System Performance Summaries

Transportation system performance results is summarized at three basic levels of detail: for the entire San Francisco Bay Region; for each of the nine Bay Area counties; and for fifteen corridors. The fifteen corridors are:

1. Livermore Valley--Altamont Pass to Hayward/San Leandro
2. Metro East Bay--Crockett to Hayward
3. Contra Costa County--Route 4 from Brentwood to Hercules
4. I-80 from Solano County to the Bay Bridge
5. Napa Valley, including Vallejo
6. Golden Gate--Sonoma, Marin and Northern San Francisco
7. I-680 Corridor--Northern section from Pleasanton to Fairfield
8. I-680 Corridor--Southern section from Pleasanton to San Jose
9. Fremont-South Bay
10. Santa Clara County--Central area including Silicon Valley
11. US 101 Southern section from Gilroy to Palo Alto
12. US 101 Northern section from San Mateo to San Francisco
14. Transbay: Dumbarton and San Mateo Bridges
15. Transbay: San Rafael Bridge Corridor

These corridors were defined to provide useful information for corridor studies that are currently underway (e.g., CalTrain, I-80 and Fremont-South Bay), as well as those planned for the future. The present study will use information about Corridor 11 - US 101 Northern Section from San Mateo to San Francisco, as well as Corridor 12, the south end of the US 101 through San Jose to Gilroy.

4.0 Methodology for Ridership Forecasts

This chapter describes the approach that will be used to prepare the ridership forecasts for the CalTrain Downtown Extension Project. The forecast results will be reported in four levels of detail, from the most general to the most specific. Three of the MTC RTP Alternatives will be used as the basis for analyzing the three Downtown Extension Alternatives. Each of these alternatives is described, followed by a discussion of their correspondence. Finally, an overview of the sequence of tasks in the forecasting effort is provided.

4.1 Objectives for Preparing Forecasts

The ridership forecasts prepared for this study will be used to assess the environmental impact of the project and its alternatives. Though the number of passengers that will ride CalTrain is interesting information, in terms of environmental impacts, the ridership estimates are more important as input to other analyses, such as air quality, traffic congestion, parking demand, and social equity. Nonetheless, it needs to be recognized that the ridership forecasts and other transportation statistics will also be used to assess the benefits of the CalTrain Downtown Extension Project, and compare the project's relative cost effectiveness with other transportation investments. While this is an inevitable occurrence, it must be remembered that the primary objective of this analysis is to assess environmental impacts.

4.1.1 Categories for Reporting Results

Travel forecasting information will be reported in four categories range in detail from the most general to the most specific. Chapter 5.0 describes in detail the data that will presented in the Ridership Forecasting Results Report.

4.1.2 Corridor Statistics

At the most general level, data regarding travel by the different transit and highway modes in the Peninsula Corridor will be reported for comparative purposes. For the purposes of this EIS/EIR, the Peninsula Corridor will be defined as the major transportation facilities that cross the San Mateo - San Francisco county line. This includes CalTrain, BART, SamTrans bus service to Downtown San Francisco, and the Interstate 280 and US 101 freeways, and major arterials.

4.1.3 CalTrain Service Statistics

At the next level, ridership and related information on the CalTrain service will be reported in more detail than the corridor data. Information on CalTrain service will include total system ridership, station boardings and alightings, parking demand, and representative travel times by typical trips.

4.1.4 Evaluation of CalTrain Extension Alternatives

At the third level, comparative data will be reported to assist in evaluating the Downtown Extension alternatives. For the most part, this will take the form of summaries of data already presented for the corridor and CalTrain service. It will consist of summary tables comparing measures such as overall ridership and typical travel times.

4.1.5 Assessment of Local Transportation Impacts

Finally, information on the local transportation impacts of the station relocation project will be provided. Local transportation impacts include the effects of the project on pedestrian and vehicular circulation in the vicinity of the relocated station in Downtown San Francisco. Vehicular circulation impacts include changes to traffic, parking and transit patterns in the area. These impacts will be addressed in the transportation section of the EIS/EIR, and will not be discussed in the Ridership Forecasting Results Report. Information from the ridership forecasts will be one of the inputs to the assessment of local transportation impacts. This information will be supplemented with traffic data and analysis tools developed for the Mid Embarcadero Roadway/Terminal Separator Structure Study, the Transbay Terminal Study, plus original research and analysis of pedestrian and transit impacts to be conducted as part of this study. Details regarding the methodology of the assessment will be provided in the Transportation Impacts section of the EIR/EIS.

The project may also create impacts at stations on the Peninsula due to higher train ridership, which in turn would increase parking demand and traffic volumes around the stations. These impacts will be assessed by examining approximately four stations with significant drive-access activity. The ridership forecasts will be used to estimate parking demands at these stations. This demand will be applied to local traffic data obtained from the appropriate local jurisdiction. As with the local transportation impacts in Downtown San Francisco, the methodology and analysis will be reported in the Transportation Impacts section of the EIR/EIS.

4.2 Description of 1994 MTC RTP Runs

The Bay Area transportation network includes airports, seaports, interstate and state freeways, local streets and roads, expressways, bike paths, sidewalks, and a wide assortment of transit technologies--heavy rail, light rail, intercity rail, buses, trolleys, cable cars, and ferries. As the designated metropolitan planning organization for the Bay Area, MTC is responsible for preparing a long range Regional Transportation Plan (RTP).

The RTP includes three major elements:

1. A **Policy Element** that considers important transportation issues and describes the transportation goals and objectives.

2. A **Financial Element** that summarizes the cost of plan implementation, and compares these costs to a realistic projection of available revenues. The RTP should include only those projects that can actually be financed by available funds over a 20 year span.

3. An Action Element that describes the projects, programs and actions necessary to implement the plan.

The major financial assumption governing the RTP is that existing sources of federal, State, and regional revenues are assumed to continue throughout the 20-year time frame with the exception of those county transportation ½ cent sales tax measures which, by law, must sunset before 2013. No new additional revenue sources are assumed to become available. The sum of these revenues over 20 years amounts to $74 billion, and constitutes the financial resources for the RTP.

Seventy billion dollars of RTP funding represent fund sources and amounts primarily dedicated or committed for specific purposes. Four billion dollars are uncommitted amounts available for unfunded or underfunded projects and various transportation and transit modes and programs for capital investment. In other words, while the entire RTP budget amounts to $74 billion, new projects and programs are limited to four billion dollars in revenue over the next 20 years.

Three alternatives analyzed in the 1994 Regional Transportation Plan (RTP) will be used as the basis for the ridership forecasts for the CalTrain Downtown Extension:

- Draft Project;
- Alternative 1A; and
- Final Project

The three alternatives represent different ways to invest the $4 billion dollars on new projects and programs.

4.2.1 Draft Project

The Action Element of the Draft Project Alternative defines the investment strategy for the region's projected $4 billion in discretionary funds over the next 20 years. Approximately 30 percent of the new funding goes to cover shortfalls for streets and roads maintenance, transit system capital assets, and seismic retrofit of seven state-owned bridges which cross the Bay and delta. The Draft Project Alternative also expands the region's transit network, including several light rail extensions in Santa Clara County and a BART extension to serve the San Francisco Airport. Existing transit systems are also upgraded, including replacement of AC Transit diesel buses with electric trolley buses, and a new connection between BART and the Amtrak Capitols intercity passenger rail service at Union City.

The Draft Project Alternative improves the High Occupancy Vehicle (HOV) system on the region's highways by adding new lanes on high-volume corridors and closing gaps in the existing HOV system. Other highway improvements include interchange modifications, auxiliary lanes, and selective road widening to relieve bottlenecks. Arterial improvements primarily relate to relieving routes in congested highway corridors.

Operational improvements include the Traffic Operation System (TOS) designed to smooth traffic flows and improve incident management on the region's highways. Translink is an operational

strategy to improve coordination of existing transit systems through a universal fare collection system for bus and rail operators. The Draft Project Alternative includes funding for signal timing and arterial improvements such as left-turn channels and spot widening to improve traffic flows.

The RTP also provides freight mobility improvements, such as the Port of Oakland joint-intermodal terminal, improvements to railroad tunnels serving the Port of San Francisco, a truck bypass lane at the I-205/580 interchange, and truck weigh-in-motion facilities. Finally, funding for undefined bicycle and pedestrian improvements is included in each county. These improvements are generally determined by cities and counties on through local processes on an annual basis.

4.2.2 Alternative 1A

This alternative reflects the priorities of the county Congestion Management Agencies (CMAs), county sales tax programs for transportation improvements, transit providers, and other local and regional transportation planning agencies. The projects on this list were drawn primarily from several plans and programs:

- Congestion Management Programs,
- Countywide Plans,
- Sales Tax Measure Programs,
- Short-Range Transit Plans,
- MTC Resolution 1876 Regional Rail Agreement, and
- Bid lists for STP, CMAQ and State Flexible Congestion Relief funds.

Table 3.1-1 of the RTP Draft EIR outlines the main differences between the Draft Project Alternative and this alternative. Alternative 1A would result in more street and highway lane miles than the Draft Project Alternative. Alternative 1A also contains several significant transit projects not contained in the Draft Project Alternative. These include the BART extension to Warm Springs and the Capitol Corridor light rail project in San Jose.

4.2.3 Final Project

The RTP Final Project model run was conducted in June 1994. It tested a modified version of the Draft Project definition. The modifications resulted from comments received on the Draft EIR for the RTP. In terms of the Peninsula Corridor, the most significant difference between the Draft and Final Project Alternatives is that CalTrain is assumed to terminate at Fourth and Townsend in the Draft Project, and at Beale and Market in the Final Project.

4.3 Definition of CalTrain Alternatives to be Analyzed

Three alternatives will be analyzed for the Downtown Extension Project.

4.3.1 No Build

This alternative retains the present CalTrain terminal at Fourth and Townsend and is used as a basis for comparison with other downtown connection options. Access to downtown San Francisco would

be improved with the extension of Muni Metro to within one block of the terminal. Minor modifications would be made at the terminal to improve passenger convenience and transfers to Metro and downtown express busses (consistent with the JPB's Phase I study). This alternative was labeled Alternative 1 in the 1994 MTC/JPB study.

4.3.2 Transbay Terminal

This alignment would follow Townsend Street, transition from surface to subway alignment in the proximity of Fourth Street, continue through the Collin P. Kelly/Essex corridor to the Transbay Terminal, where it would transition from subway through Rincon Hill to aerial structure. The alignment would then use the existing Transbay Terminal bus ramps as the trackbed for the CalTrain tracks into the terminal. A new deck would be constructed above the existing bus level for bus operators and the existing westerly bus ramp would be widened to provide adequate ingress and egress and mid-day bus storage (the remaining ramps would not be needed and could be removed to clear the area for redevelopment). A new building on the Transbay Terminal site is also being studied. The Transbay Terminal Alternative would employ electric locomotive equipment. The stub end track arrangement requires that the locomotives push the CalTrain gallery cars into the terminal for loading/unloading and pull the train out of the terminal for the return trip down the Peninsula. This alternative was labeled Alternative 3B in the 1994 MTC/JPB study..

4.3.3 Market & Beale

This alignment follows Beale Street to Market Street. More analysis is required to determine the exact location of the surface/subway transition and the best east/west surface street alignment to Market Street; Townsend and King Streets are being considered as potential alignments. This terminal would provide direct connections to both BART and Muni Metro at the Embarcadero Station and Muni surface routes on Market Street. The terminal would be adjacent to the existing Transbay Terminal (or the proposed relocated Transbay Terminal) and be in close proximity to cable cars and the ferry terminal. This alternative was labeled alternative 8B in the 1994 MTC/JPB study.

4.4 Correspondence Between CalTrain and RTP Alternatives

Table 1 summarizes the correspondence between the Downtown Extension Alternatives and the RTP Alternatives.

Table 1
MTC Model Runs Used for Analysis

Downtown Extension Analysis Alternative	MTC 1994 RTP Alternative Model Run
No Build	Draft Project
Transbay Terminal	Alternative 1A
Market & Beale	Final Project

4.5 Steps To Be Taken For Preparing Ridership Forecasts

The process for developing the ridership forecasts involves a number of steps.

4.5.1 Obtain 1994 RTP Model Results From MTC

Consultant team personnel have met with MTC modeling staff to obtain a thorough understanding of the background and assumptions of the 1994 RTP model runs. MTC staff have also provided electronic and paper files of model inputs and results.

4.5.2 Review Results for Issues Requiring Manual Adjustment

The consultant team has reviewed the assumptions and compared these assumptions to the needs of the EIS/EIR. The team has identified those issues that will require manual adjustment of the RTP model output to make it meet the requirements of the EIS/EIR. These needs are described in Chapter 6 of this report.

4.5.3 Identify Methods for Performing Manual Adjustments

The team has made a preliminary determination of the methods that will be used to adjust the RTP forecasts. These are described in Chapter 6. As the effort moves forward, these methods will be refined and their final form will be described in the Ridership Forecasting Results Report.

4.5.4 Document Forecasting Methodology

This report describes the approach to preparing ridership forecasts. It has been prepared for review by the project team to obtain concurrence with the approach before it is applied.

4.5.5 Perform Manual Adjustments to Address Issues

The consultant team will apply the adjustment methods to the RTP forecasts.

4.5.6 Prepare Draft and Final Ridership Forecasting Results Reports

The consultant team will prepare a Draft Ridership Forecasting Results Report for review by interested parties participating in the study. Comments and suggested revisions to the Draft Report will be incorporated into the Final Ridership Forecasting Results Report.

5.0 Analyses to be Performed

This chapter describes the types of information to be reported on each of the project alternatives, such as systemwide transit-linked trips, daily boardings and alightings, mode share, trips by mode of access, and number of transfers. A listing of the figures and tables to be included in the Ridership Forecasting Results Report appears in Appendix A.

5.1 Corridor Statistics

The RTP travel demand forecasts that will be used in this study result from applying a computer model that is driven by two primary inputs: 1) transit and highway network coding that accurately represents, in computer descriptions, the available transportation system for each of the transit alternatives described above; and, 2) MTC regional demographic forecasts that account for the level of land use activity in each of the Transportation Analysis Zones (TAZs) that comprise the MTC model area.

Comparisons of the transit service characteristics among all alternatives will be conducted. By definition, all alternatives beyond the No Build would improve the level of transit service in the subregion. The improvements rely on an integrated system of BART, CalTrain, express bus, Muni Metro LRT service, expanded local feeder bus routes, and expanded park-and-ride lots. The transit characteristics will include service levels, number of routes, number of vehicles and other system features like parking spaces and stations/transfer centers.

Patronage forecasts are a key measure of the transit mobility provided by each alternative. These forecasts of transit ridership also are used to assess other factors such as air quality benefits, roadway congestion relief, revenue and fare box projections, energy use savings and vehicle fleet requirements.

5.1.1 Transit - Linked Trips

Transit-linked trips represent a key measure of patronage expressed in terms of total trip interchanges by transit. An individual linked trip can include more than one boarding, representing the entire zone-to-zone trip. The results are also separated into work and non-work categories.

5.1.2 Transit Mode Share

Travel by transit as a percentage of total travel is another important measure of patronage to compare across the range of alternatives.

5.1.3 Transfers Between Modes

The number of transfers is another important measure of transit convenience of service. Transfers can occur among all transit services. A lower number of transfers can indicate that service is being provided directly from an origin to a desired destination.

5.1.4 Travel Statistics (VMT, VHT, Delay, Congestion)

The RTP model runs produce several statistics that summarize travel conditions and performance of the regions roadway facilities. The measures that are relevant to the Downtown Extension Project include:

1. **Average daily roadway speeds for all highway facilities.** This data has been compiled for the corridor, county, and regional levels. The most important factors influencing roadway speeds are the implementation of the traffic operations system (TOS) program, and the provision of additional capacity, either as mixed-flow or HOV lanes.

2. **A.M. Peak Hour Distribution of Vehicle Miles Traveled (VMT) by volume-to-capacity (V/C) ratios.** Three categories of V/C rations are given: below 0.75 (level-of-service, or LOS, A through C), 0.75 to 1.0 (LOS C through E), and greater than 1.0 (LOS F). Facility types are classified by freeways and other facilities (expressways and arterials).

3. **Vehicle hours of delay compared to total vehicle hours of travel (VHT).** Comparing A.M. peak hour total vehicle hours of delay (VHD) to total vehicle hours of travel (VHT) gives an estimate of what proportion of total A.M. peak hour travel results from congestion.

5.1.4 Screenline Traffic Data

In the RTP analysis, A.M. peak hour highway speeds and volume to capacity (V/C) ratios were calculated at a number of "screenlines" on heavily traveled key Bay Area routes.

5.2 CalTrain Statistics

Forecast results in this category will provide a comprehensive picture of how the different CalTrain Downtown Extension alternatives will operate and serve the transit market.

5.2.1 Station by Station Ons and Offs

Daily ridership will be forecast for each alternative. Linked transit trips will be calculated based on the trip interchanges at the "planning area" level. Daily and peak hour line loads, as well as boardings and alightings at stations and transfer centers, will also be produced.

5.2.2 Mode of Arrival

Travel by transit is forecast with the MTC model for walk (to bus or rail) and drive access (drive alone, rideshare and drop-off combined) modes. Generally, bus transit trips which begin as walk access are further stratified as bus access trips to rail stations along with walk and drive access. How the overall mode of access to transit service might change as a result of growth in CalTrain

travel demand is an important issue. Pedestrian access and local traffic impacts will also be considered.

5.2.3 Parking Demand

Mode of access changes will also affect the sizing of park-and-ride lots at stations and the potential mitigation measures necessary to deal with additional auto demand at suburban stations on the Peninsula.

5.2.4 Travel Time for Example Trips

Transit travel times across the alternatives are a good comparison measure of system performance. Key trip interchanges will be selected to represent major travel movements within the corridor. The relative travel times among the alternatives would differ because of running speed, wait time, walk time, number of stops along the route, and the need to transfer. The trips that will be analyzed are shown in Table 2. The components of several of these trips are graphically depicted in Figure 2.

Table 2
Travel Characteristics for Selected Trips

1. San Jose to San Francisco

Segment:	Access - Car		CalTrain		MUNI Shuttle			CalTrain Extension		TOTAL
Component:	Drive	Park	Wait	Ride	Wait	Ride	Walk	Ride	Walk	
Cost:			-		-		-		-	
No Build								-	-	
TBT					-	-	-			
Beale					-	-	-			

2. Sunnyvale to San Francisco

Segment:	Access - Bus			CalTrain		MUNI Shuttle			CalTrain Extension		TOTAL
Component:	Walk	Wait	Ride	Wait	Ride	Wait	Ride	Walk	Ride	Walk	
Cost:	-	-		-		-		-			
No Build									-	-	
TBT						-	-	-			
Beale						-	-	-			

3. San Mateo to San Francisco

Segment:	Access - Walk	CalTrain		MUNI Shuttle			CalTrain Extension		TOTAL
Component:	Walk	Wait	Ride	Wait	Ride	Walk	Ride	Walk	
Cost:	-	-		-		-		-	
No Build							-	-	
TBT				-	-	-			
Beale				-	-	-			

Table 2
Travel Characteristics for Selected Trips

4. Burlingame to San Francisco

Segment:	Access - Car		CalTrain		MUNI Shuttle			CalTrain Extension		TOTAL
Component:	Drive	Park	Wait	Ride	Wait	Ride	Walk	Ride	Walk	
Cost:			-		-		-		-	
No Build								-	-	
TBT					-	-	-			
Beale					-	-	-			

5. San Bruno to San Francisco

Segment:	Access - Bus			CalTrain		MUNI Shuttle			CalTrain Extension		TOTAL
Component:	Walk	Wait	Ride	Wait	Ride	Wait	Ride	Walk	Ride	Walk	
Cost:	-	-		-		-		-		-	
No Build									-	-	
TBT						-	-	-			
Beale						-	-	-			

6. San Francisco to San Francisco Airport Terminal

Segment:	Access - Walk	MUNI Shuttle		CalTrain Extension		CalTrain		Airport Light Rail			TOTAL
Component:	Walk	Wait	Ride	Wait	Ride	Wait	Ride	Wait	Ride	Walk	
Cost:	-	-		-		-		-		-	
No Build				-	-						
TBT		-	-			-					
Beale		-	-			-					

Table 2
Travel Characteristics for Selected Trips

7. North Beach to Airport Maintenance Area

Segment:	Access - Bus to 4th & Townsend			Access - Bus to New Terminal			CalTrain Extension		CalTrain		Airport Light Rail			TOTAL
Component:	Walk	Wait	Ride	Walk	Wait	Ride	Wait	Ride	Wait	Ride	Wait	Ride	Walk	
Cost:	-	-		-	-		-		-		-		-	
No Build				-	-	-	-	-						
TBT	-	-	-						-					
Beale	-	-	-						-					

8. Palo Alto to Berkeley

Segment:	Access - Walk	CalTrain		MUNI Shuttle		CalTrain Extension	BART				TOTAL
Component:	Walk	Wait	Ride	Wait	Ride	Ride	Walk	Wait	Ride	Walk	
Cost:	-	-		-			-	-		-	
No Build						-					
TBT				-	-						
Beale				-	-						

9. Oakland to San Carlos

Segment:	Access - Car		BART		MUNI Shuttle			CalTrain Extension			CalTrain			TOTAL
Component:	Drive	Park	Wait	Ride	Walk	Wait	Ride	Walk	Wait	Ride	Wait	Ride	Walk	
Cost:			-		-	-		-	-		-		-	
No Build								-	-	-				
TBT					-	-	-				-			
Beale					-	-	-				-			

Table 2
Travel Characteristics for Selected Trips

Location:	Definition:
Airport Maintenance Area	United Airlines Maintenance Facility
Berkeley	Oxford Street and Hearst Avenue
Burlingame	El Camino Real and Hillside Drive
North Beach	Columbus Avenue and Stockton Street
Oakland	Broadway and College Avenue
Palo Alto	Embarcadero and Middlefield Roads
San Bruno	Sneath Lane and Skyline Boulevard
San Carlos	Holly Street and San Carlos Avenue
San Francisco	Second and Market Streets, southeast corner
San Francisco Airport Terminal	South Terminal
San Jose	Lincoln Avenue and Willow Street
San Mateo	Third Avenue and El Camino Real
Sunnyvale	Hollenbeck and Fremont Avenues

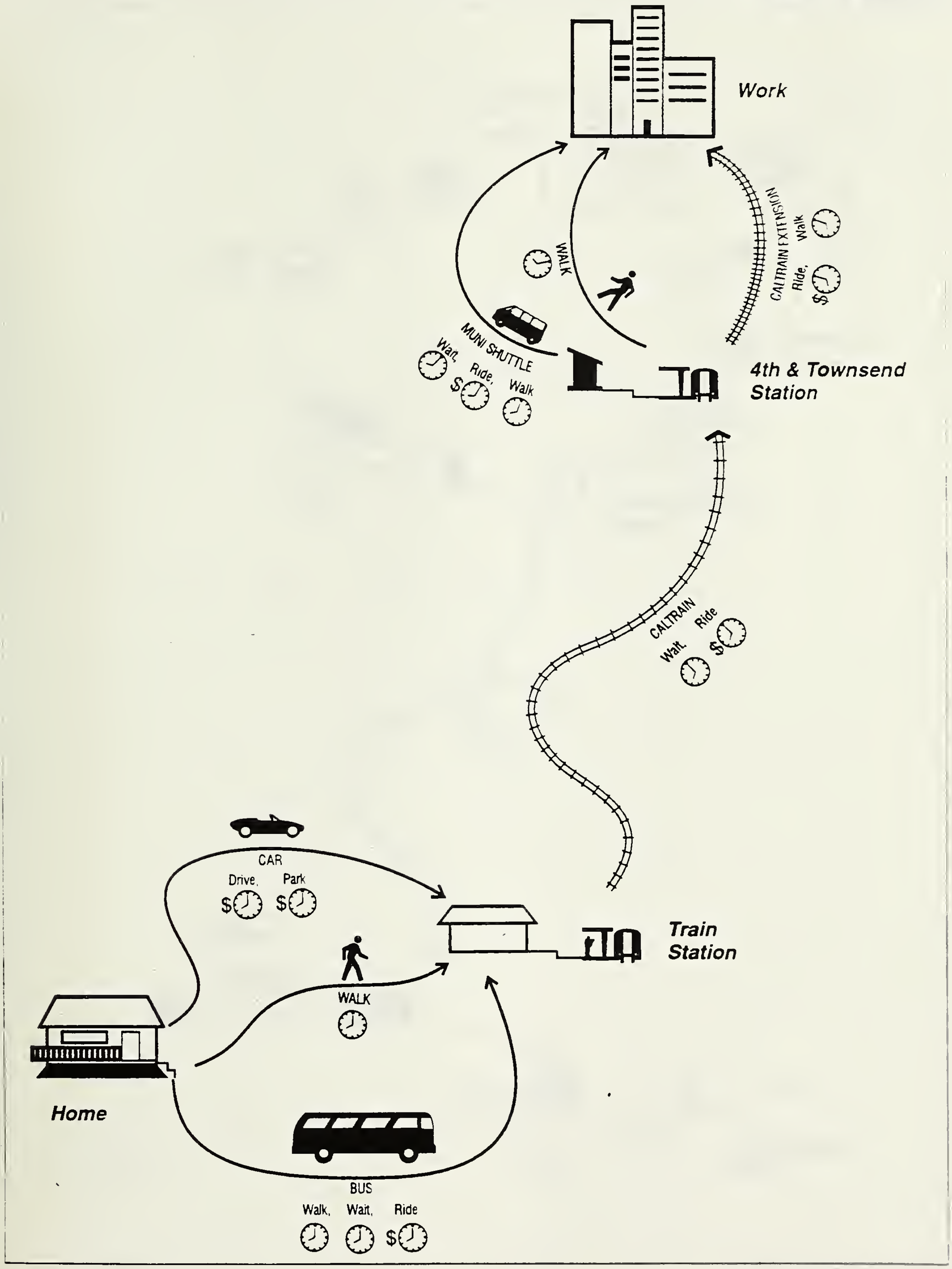


Figure 2A

TYPICAL COMMUTE TRIP FROM PENINSULA TO SAN FRANCISCO

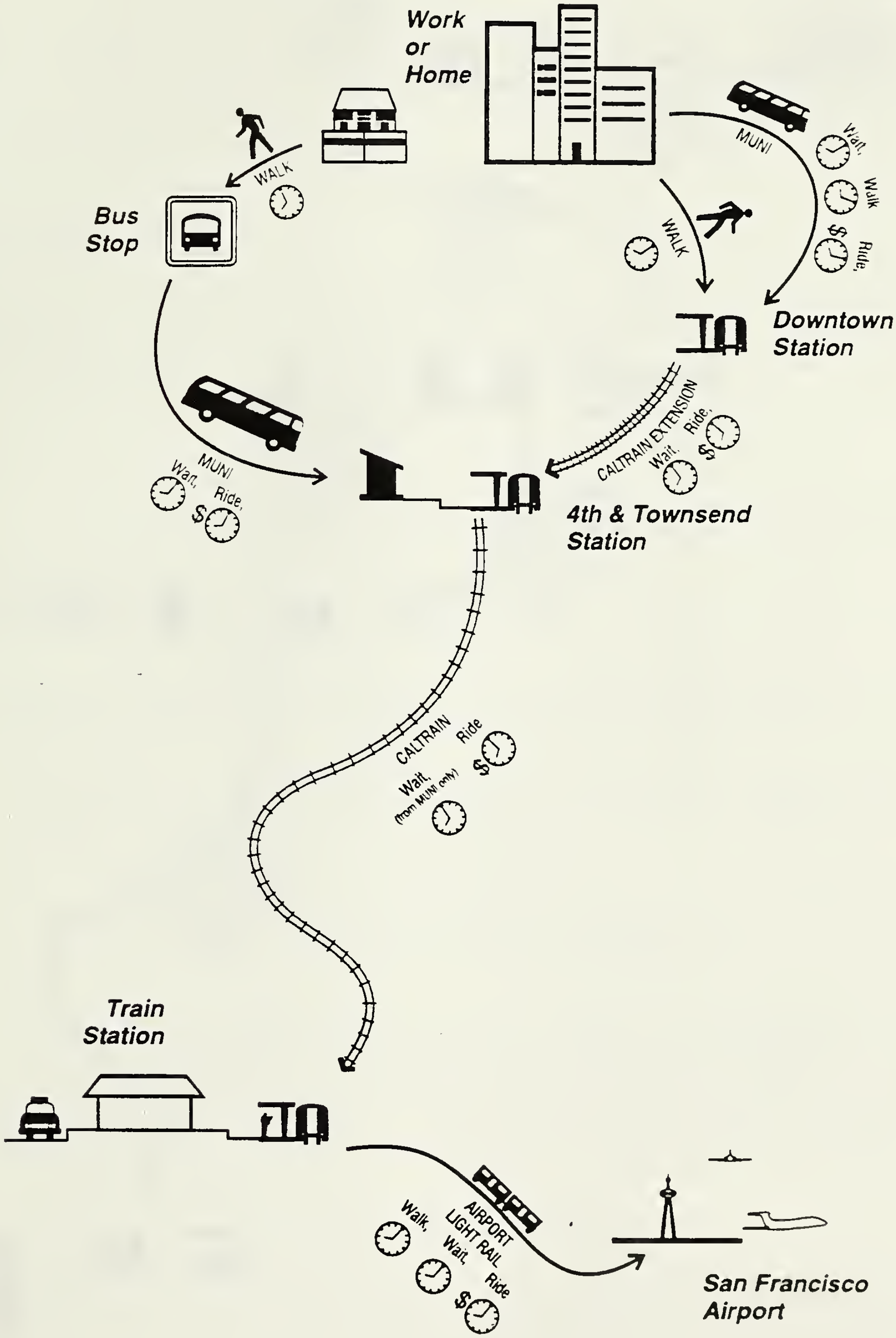


Figure 2B
TYPICAL TRIP FROM SAN FRANCISCO TO AIRPORT

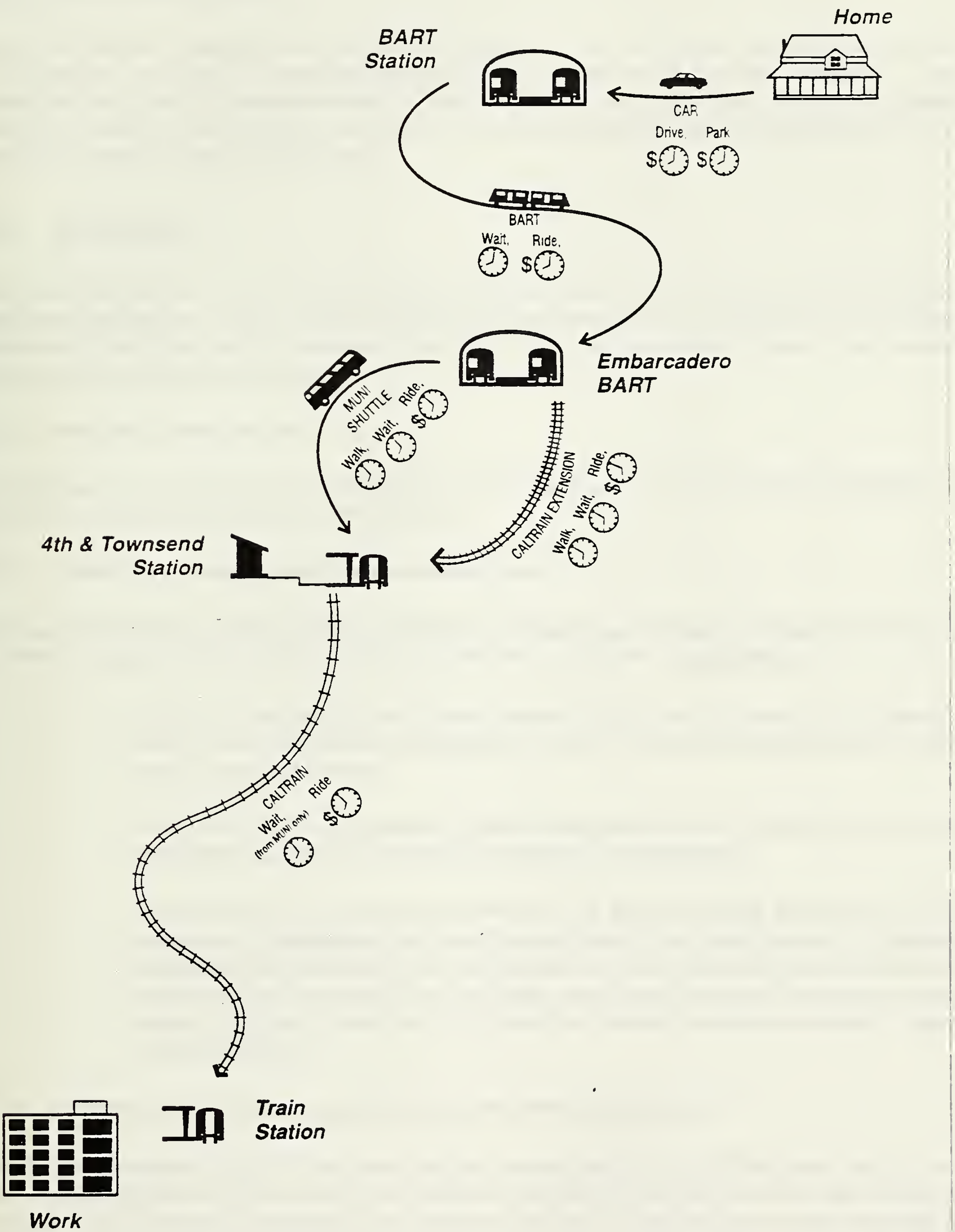


Figure 2C

TYPICAL COMMUTE TRIP FROM EAST BAY TO PENINSULA

5.2.5 Annualization Factors

Since the CalTrain ridership forecasts will be reported in terms of weekday boardings, factors will be developed to expand the weekday numbers to cover weekend and holiday operations. The factors will be applied to obtain estimates of annual ridership, which will be used to prepare revenue forecasts. Revenue forecasts are a component of the assessment of subsidy requirements and the overall cost-effectiveness of the project.

5.3 Evaluation

The evaluation measures will be used to compare the costs and benefits of the CalTrain Downtown Extension alternatives. Most of these measure will have already been reported as either corridor statistics or CalTrain service statistics. Here, they will be reformatted into tables to allow easy comparisons between alternatives.

5.3.1 Net New Transit Riders

The difference in transit-linked trips between each alternative and the No Build Alternative is commonly referred to as "net new transit riders."

5.3.2 Transit Trip Interchanges (Winners and Losers)

A series of trip-table comparisons will be made for the patronage forecasts across all alternatives in order to compare and evaluate the following "winners and losers" characteristics:

- Significant changes in travel times between major travel corridors and for specific zones. Both district level and selected zone data will be summarized based on input from the consultant team.

- Transit trip interchanges between major travel corridors and specific zones. Again, both district level and selected zone data will be summarized.

- A trip table of the differences between the No Build and Build alternatives will be developed. The difference in trips will be assigned to the transit network to illustrate those areas that would gain new transit trips as well as those areas that would lose transit trips as compared to the No Build alternative. The "lost" transit trips might lead to a decision to add back in express bus services previously curtailed in favor of the CalTrain line.

5.3.3 CalTrain Use for Trips from Downtown San Francisco to Airport

San Francisco Airport is one of the major activity centers along the CalTrain route, both for air passengers and airport employees. An extension of CalTrain service closer to the center of Downtown San Francisco could affect the number of people using CalTrain to reach the Airport. Results from the RTP model runs pertaining to riders with Airport destinations will be extracted and

summarized. As discussed in Section 6.1.3. the configuration of the connection between CalTrain and the Airport could have an impact on the use of CalTrain for Airport-bound trips.

5.3.4 Inputs to Operating & Maintenance Cost Model

The transit service operating characteristics will result from the consultant team and transit agency planning staff working together during the equilibration assessment process (see Section 6.3.5) to assure that the transit services supplied meet the forecast transit demands within acceptable load factors. The transit operating service assumptions will then be used as input to calculations of annual operating measures of CalTrain and bus revenue hours and miles, as well as other derived measures that are further input to the operating and maintenance cost estimating models. The bus and CalTrain operating measures required for the O&M cost estimating model will be calculated in an independent spreadsheet developed for the study. The results from these calculations will be checked against the transit service statistics output for MTC model travel forecasts.

6.0 Manual Adjustments

Using the RTP model runs as the basis for the EIS/EIR forecasts will require a number of manual adjustments. These adjustments can be grouped into three categories: alternative description issues, model structure issues and model input assumptions and application issues.

6.1 Alternative Description Issues

Some of the manual adjustments are made necessary by the definition of the travel network in the MTC model, and the level of service assumed to be operated on that network. These issues are independent of the mathematical formulations used by the model and factors such as zone size.

6.1.1 Number of CalTrain Weekday Trains

CalTrain currently operates 59 one-way trains each weekday. One additional train is operated on Friday nights. One additional special event train operates sporadically on weeknights to serve events at the San Jose Arena. Therefore, the maximum number of trains that could operate on a weekday is 61.

For the 1994 RTP model runs, the Draft Project and Alternative 1A assumed that CalTrain would have 87 one-way trains operating each weekday. The Final Project run assumed there would be 65 weekday trains (*MTC Internal Memorandum RE: Analysis of 60 Daily CalTrain runs in Year 2010 BART-SFO Forecasts, from Ron West to Chris Brittle, March 24, 1995)*. The 87 train and 65 train figures evolved from a series of decisions made over time as travel forecasts were prepared for the Peninsula Corridor. The first decision was to assume 114 trains for the first round of forecasts prepared in 1990-91 for the BART-SFO Alternatives Analysis. At the time these forecasts were made, CalTrain ran 52 trains. The increase from 52 to 114 trains was assumed to be accomplished by:

1. Increasing frequencies during off-peak periods by reducing headways from two hours to fifteen minutes;

2. Adding some peak direction commute runs;

3. Decreasing reverse commute headways from 30 minutes to 15 minutes in the peak hour; and

4. Adding a reverse commute express train.

This increase in service was consistent with the CalTrain Terminal Relocation Study of 1988-9.

The second decision was to reduce service from 114 to 86 trains per day as a result of an equilibration round of forecasting for the BART-SFO Alternatives Analysis (see Section 6.3.5 for a discussion of equilibration). Service was reduced by:

1. Increasing off-peak headways from fifteen minutes to thirty minutes;

2. Dropping some of the peak direction commute runs that had been added to achieve the 114 train schedule; and

3. Increasing reverse commute headways from fifteen minutes to thirty minutes.

It appears that one additional train was assumed for the RTP runs (increasing the total from 86 to 87) in order to achieve consistency with the CalTrain operating pattern in effect in 1994.

The last decision occurred when the RTP Final Project run was prepared assuming a 65 train schedule. Service was reduced by increasing off-peak headways from thirty minutes to one hour.

For the Downtown Extension EIS/EIR, the only difference that could be of concern is the difference between 87 trains in the Draft Project and Alternative 1A runs, and the 65 trains in the Final Project run. This difference is totally the result of increasing off-peak headways from thirty minutes to sixty minutes.

It turns out that the MTC model cannot distinguish between these two levels of off-peak service. To the model, they appear exactly the same, and generate the same ridership. This is because the model does not assign trips to individual trains. Instead, it treats the CalTrain route as a continuous pipeline that serves trips on demand. Headways are indirectly modeled through their effect on waiting time. If headways are longer, the model assumes that the waiting time will be longer.

Waiting time is part of the calculation of total travel time by which different travel options are compared in the trip assignment process. Waiting time is assumed to be one-half of the headway. Thus the model assumes that using a transit line that operates every five minutes and has a waiting time of 2.5 minutes is more attractive than a line that operates every ten minutes and has a waiting time of 5 minutes.

However, once headways are lengthened beyond 20 minutes, the model assumes that the wait time becomes constant at 10 minutes. This is because the model assumes that riders will know the train schedule and time their arrival to meet the train. Therefore, the model is assuming that average waiting time for someone who knows the train schedule is 10 minutes. Because of this characteristic, the model assumes that off-peak service operating at 30 minute headways (as in the Draft Project and Alternative 1A runs) is just as attractive as service operating at 60 minute headways (as in the Final Project run). This means that the ridership results from the Draft Project, Alternative 1A and Final Project runs can all be directly compared, despite the apparent differences in the level of train service.

Even though the RTP runs are comparable, the number of weekday trains assumed for the Downtown Extension Study may be different than that assumed in any of the RTP runs. Manual adjustments to all the alternatives will be needed to account for the improved headways in the off-peak.

6.1.2 CalTrain Travel Time Differences

Changes in the operation of CalTrain can have effects on the travel time experienced by riders, and hence, the relative attractiveness of the service. Operational factors that could influence travel time and vary for the Downtown Extension alternatives include: diesel versus electric operation, number of grade crossings, and changes to the signaling system.

For example, all of the RTP runs assume that CalTrain would be upgraded by electrifying the line. As a result of increased train performance, travel times on CalTrain were assumed to be shorter than those of the existing diesel locomotive operation. One of the options that may be explored in the EIS/EIR is continued operation of diesel locomotives through the tunnel to the relocated station. To forecast ridership for this option, the RTP results will need to factored downward to reflect travel times consistent with the existing operation. The specific factors will be documented in the Ridership Forecasting Results Report.

6.1.3 Connections Between CalTrain, BART, and the Airport Light Rail System

All of the RTP alternatives assumed that a new transfer station would be constructed near the Airport west of Route 101. This station would allow transfers between CalTrain, BART, and the Airport Light Rail System (ALRS). The ALRS would carry passengers from the transfer station directly to stations at each of the Airport Terminals and to employment centers elsewhere in the Airport complex. Following completion of the RTP, the BART Board and SamTrans Board adopted a preferred route for the BART SFO (designated Alternative VI in the BART SFO EIR/EIS) that routes BART through the planned International Terminal and on to a joint BART/CalTrain station in Millbrae. In this configuration, the ALRS would connect with BART at the International Terminal BART station but would not connect directly with CalTrain. Passengers disembarking at the International Terminal BART station would still use the ALRS to reach other terminals and employment areas. CalTrain passengers wishing to reach Airport destinations would need to transfer to BART at the Millbrae or Tanforan stations, ride BART to the International Terminal station and either transfer to the ALRS to reach their final destination at the Airport or walk directly from BART to their terminal.

This complicated series of transfers would be less attractive than the direct transfer between CalTrain and the ALRS assumed in the RTP model runs. Airport-related trips on CalTrain will need to be factored down to properly represent the current plan for connection between BART, CalTrain, and ALRS. At the same time, the ridership forecasting effort needs to acknowledge that the definition of the BART SFO extension and its relation to the ALRS is extremely fluid, and could change during the course of preparing the CalTrain Downtown Extension EIR/EIS. For example, plans could change so that the ALRS is extended to the Millbrae station to connect directly with CalTrain. Consequently, it is appropriate to report ridership figures for both scenarios: one with a direct connection between CalTrain and ALRS and one without. This will allow the range of ridership fluctuation to be "bracketed" for the two conditions.

6.1.4 Completeness of Downtown Bus System Assumptions

Proper definition of the bus system in Downtown San Francisco is much more important to accurate forecasts for CalTrain than it is for the purposes of the RTP. The model's transit network links in the

Downtown area will be thoroughly examined for completeness and accuracy. Any discrepancies will be noted and correction methods will be identified. These will be reported in the Ridership Forecasting Results Report.

6.1.5 Location of Transbay Terminal

Since the model runs have already been completed, any differences in the location of the Transbay Terminal for that assumed in RTP Alternative 1A will need to be reflected in manual adjustments to the model results. Even small differences in location can have substantial impacts on ridership, since transfer and access times could change. The size of the absolute change may be small, but since they would apply to a very high percentage of riders, the overall effect could be rather large.

6.2 Model Structure Issues

Some manual adjustments will be necessary to correct for characteristics inherent in the way the model operates, limitations of the model methodology, or definitions of model components, such as the travel analysis zones.

6.2.1 Parking Capacity Constraints at CalTrain Stations

The RTP model runs assumed that there would be no increases in CalTrain station parking, even for the alternatives that included the San Francisco Downtown Extension (*MTC Internal Memorandum RE: Analysis of 60 Daily CalTrain runs in Year 2010 BART-SFO Forecasts, from Ron West to Chris Brittle, March 24, 1995)*. During the RTP modeling process, access to CalTrain was restricted for stations that exhibited higher ridership than could be provided for by the existing parking lots. The consultant team's preliminary review of this situation indicates that CalTrain ridership may have been inadvertently reduced because the process did not allow for full use of other access mode alternatives. The model assumptions and results at a number of representative stations will be reviewed. Manual adjustment method will be defined to correct for this condition. These will be described in the Ridership Forecasting Results Report.

6.2.2 Sensitivity to Midday CalTrain Service

As described in Section 6.1.1, the MTC model is not sensitive to changes in frequency of midday CalTrain service that operates at headways longer than 20 minutes. It is possible that this deficiency may result in the RTP estimates underestimating midday ridership. The model results will be examined for such an occurrence, and if it is found, adjustments will be made. One basis for adjustments could be the ongoing CalTrain Marketing Study, which is taking a very detailed look at all aspects of CalTrain's potential ridership.

6.2.3 Model Zone Size in Downtown San Francisco

The size of the MTC model's travel analysis zones may be an issue in Downtown San Francisco. The MTC model is design for use as a regional travel model covering the nine-county Bay Area. The geographic area encompassed by any single zone depends on the density of activity in the zone. Higher density areas are represented by zones covering less acres than zones with lower density.

As a result. the zones in Downtown San Francisco are some of the smallest in area of all the zones in the model. Even so. they may still be too large to adequately forecast the effects of slight changes in the location of the CalTrain Station, such as the difference between the Transbay terminal site and the Second and Market site. While this will not appreciably affect forecasts for the aggregate CalTrain route, it may make it difficult to determine local impacts in the vicinity of the station. The issue could also affect comparison of the two sites with respect to access time between the station and Muni and BART service on Market Street. Similarly, a one-block difference may have an affect on travel time between the station and final destinations in the Financial District north of Market Street.

The magnitude of this issue will not become clear until the actual forecasting analysis is underway. It may become necessary to manually disaggregate one or more MTC zones. It may also be necessary conduct a manual sensitivity analysis to address differences in access travel times between the two station sites. The specific methods will be determined as needed and described in the Ridership Forecasting Results Report.

6.2.4 Forecast Assumptions

The RTP alternatives and model runs assumed a specific level of transportation costs such as parking fees, transit fares, transfer costs, etc. To the extent that different assumptions are more appropriate now, manual adjustments will be necessary.

6.2.5 Completeness of Model

The MTC model may not include all types of trips that could potentially use CalTrain, especially off peak and non-work trips. However the air passenger model results, which account for business travelers, visitors, and well wishers, are incorporated into the RTP forecasts.

6.3 Model Assumption and Application Issues

Some of the manual adjustments will be required because of the inputs used for the RTP runs, such as land use and demographics, or because of the way the model was applied to test the specific RTP Alternatives.

6.3.1 Land-use Changes Due to Removal of Terminal Separator Structure

At the time the RTP runs were produced, San Francisco had not decided what to do about the demolished Terminal Separator. Now, the City has adopted a policy that defines that much of the property formerly occupied by the Separator will be available for development. This means that the RTP results may need to be factored upwards to account for additional trips that will be generated by this newly-available property.

6.3.2 Land-use Changes at Mission Bay

The definition of land uses for the Mission Bay project have changed recently, and are continuing to change in response to market conditions. The model assumptions regarding the Mission Bay area

land use and transportation system will be reviewed, including the provision of a CalTrain station in the project area. Adjustments will be made as appropriate.

6.3.3 Consistency of Background Network Among Alternatives

Normally, model runs prepared for a project EIS/EIR vary the project alternative and hold all other parts of the network constant. In the case of the Downtown Extension Project, the variation would be the relatively short section of the CalTrain route between the existing station at Fourth and Townsend and the sites at Market Street, as well as any connecting bus services in this segment. Three model runs would be prepared, one for each alternative. In each run all other parts of the Bay Area transportation network would be the same. Because the RTP runs were performed to test different regional strategies, each run has a number of unique conditions in the transportation network throughout the Bay Area. For example, only the Alternative 1A run included the BART extension to Warm Springs. This project was not included in the other two runs. Similar differences occur in each of the RTP runs. For the most part, these differences are geographically far removed from the CalTrain route, and are unlikely create noticeable differences in the CalTrain ridership results. The definitions of each RTP run's transportation network will be reviewed to identify any major differences in network definition that could affect the CalTrain results. If such differences are found, factoring methods will be developed to manually adjust the RTP results to achieve consistency among the background networks.

6.3.4 Selection of Land Use, Economic, and Demographic Inputs

The RTP model runs utilized the ABAG Projections '92 as socio-economic inputs, since these were the most recent demographic forecasts available at the time the runs were prepared. These assumptions are described in Section 3.1. Since then, ABAG has produced Projections '94, which have a less optimistic view of growth in the Bay Area. It would be expected that if the model was run now using Projections '94, it would produce lower ridership figures due to reduced economic activity. Though the RTP results could be adjusted to reflect the likely effects of Projections '94, there is no good basis for developing adjustment factors, short of re-running the model, which has already been ruled out as an option. Therefore, the RTP runs will not be adjusted to account for more recent land use forecasts.

6.3.5 Equilibration Assessment

Transit service equilibration is an iterative process involving a careful review of the initial forecasts, and then adjusting the transit service assumptions to meet the peak load demands and maximum capacity standards established for the study. When model runs are prepared for a specific project, usually at least one rerun of the model forecasts under the modified service assumptions is performed. Final equilibration is determined through analysis objectives that established vehicle and headway changes to assure that all routes would achieve acceptable load factors. The peak load factor is applied to a capacity that represents a fully seated load <u>plus</u> a percentage of the seated load as standees. The standee percentage is typically different for buses, light rail vehicles, commuter rail coaches and BART cars. Peak load capacities are then determined by computing for the peak load point and direction, the number of vehicles, and then comparing these to the model-produced daily forecast appropriately adjusted to represent a comprehensive peak direction loading.

Appendix A

Tables and Figures to be Included in Ridership Forecasting Results Report

Corridor Statistics Tables:

a. Summary of Alternatives (description of alternatives, major capital improvements in corridor, transit routes, transit fleet size, annual transit hours)

b. ABAG Projections '92 Demographic Forecasts for 2010 (households, employment, trip generation by area and year)

c. Transit Service Characteristics by Alternative (number of routes, number of vehicles, number of stations, number of parking spaces, peak trains, base trains, revenue miles, revenue hours)

d. Corridor Transit Trips/Boardings by Alternative by Purpose

e. Peak Load Factors by Alternative

f. Corridor Transit Mode Share by Alternative and Area

g. Daily Vehicle (Auto) Travel by Alternative (VMT, VHT, etc.)

h. Screenline Traffic Volumes by Alternative (US 101 and I-280 at San Francisco - San Mateo county line and at San Mateo - Santa Clara county line)

Corridor Figures:

a. Zone Map

CalTrain Service Statistics

a. Daily Boarding and Alightings by Station by Alternative

b. Boardings by Area by Alternative

c. Transit Trips by Mode of Access by Alternative

d. Access Mode Volumes by Station by Alternative

e. Annualization Factors

f. Parking Demand by Station by Purpose by Alternative (for all CalTrain Stations)

g. Selected Transit Travel Times and Costs by O-D Pair by Alternative

<u>CalTrain Service Figures:</u>

a. O-D Location Map

<u>Evaluation Tables:</u>

a. Transit Route Volumes by Alternative

b. Transit Trip Interchanges by Zone By Alternative

c. Transit Travel Time Savings by Purpose by Alternative

d. Transfers between CalTrain and BART, Muni Metro, and buses

<u>Evaluation Figures:</u>

a. Transit Trip Interchange "Winners and Losers" Zone Map

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